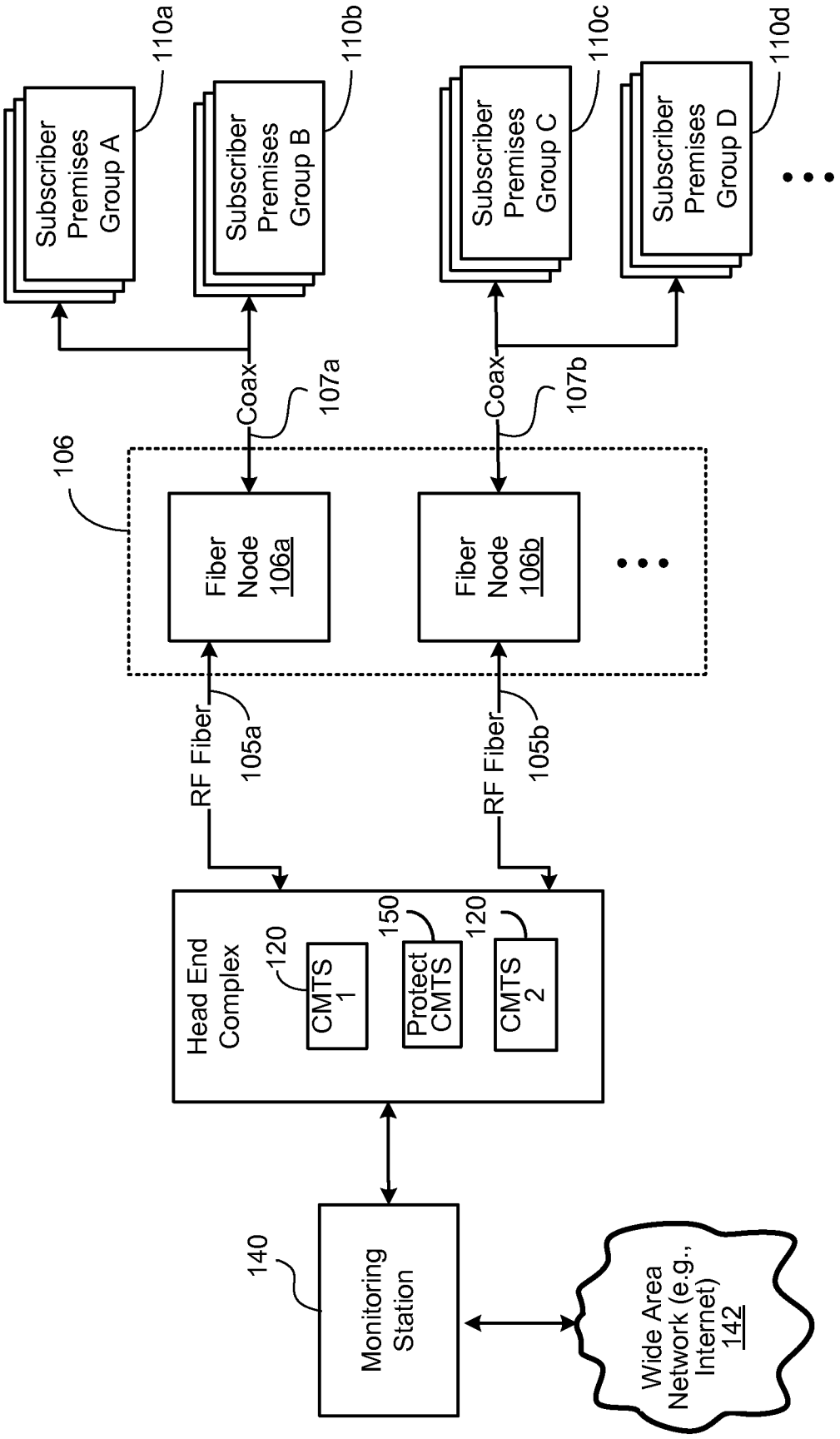

Subscriber Premises Group A
110a
Subscriber Premises Group B
110b
Subscriber Premises Group C
110c
Subscriber Premises Group D
110d
100
Coax
107a
Coax
107b
106
Fiber Node 106a
Fiber Node 106b
RF Fiber
105a
RF Fiber
105b
Head End Complex
120
CMTS 1
150
Protect CMTS
120
CMTS 2
140
Monitoring Station
Wide Area Network (e.g., Internet) 142

Fig. 1

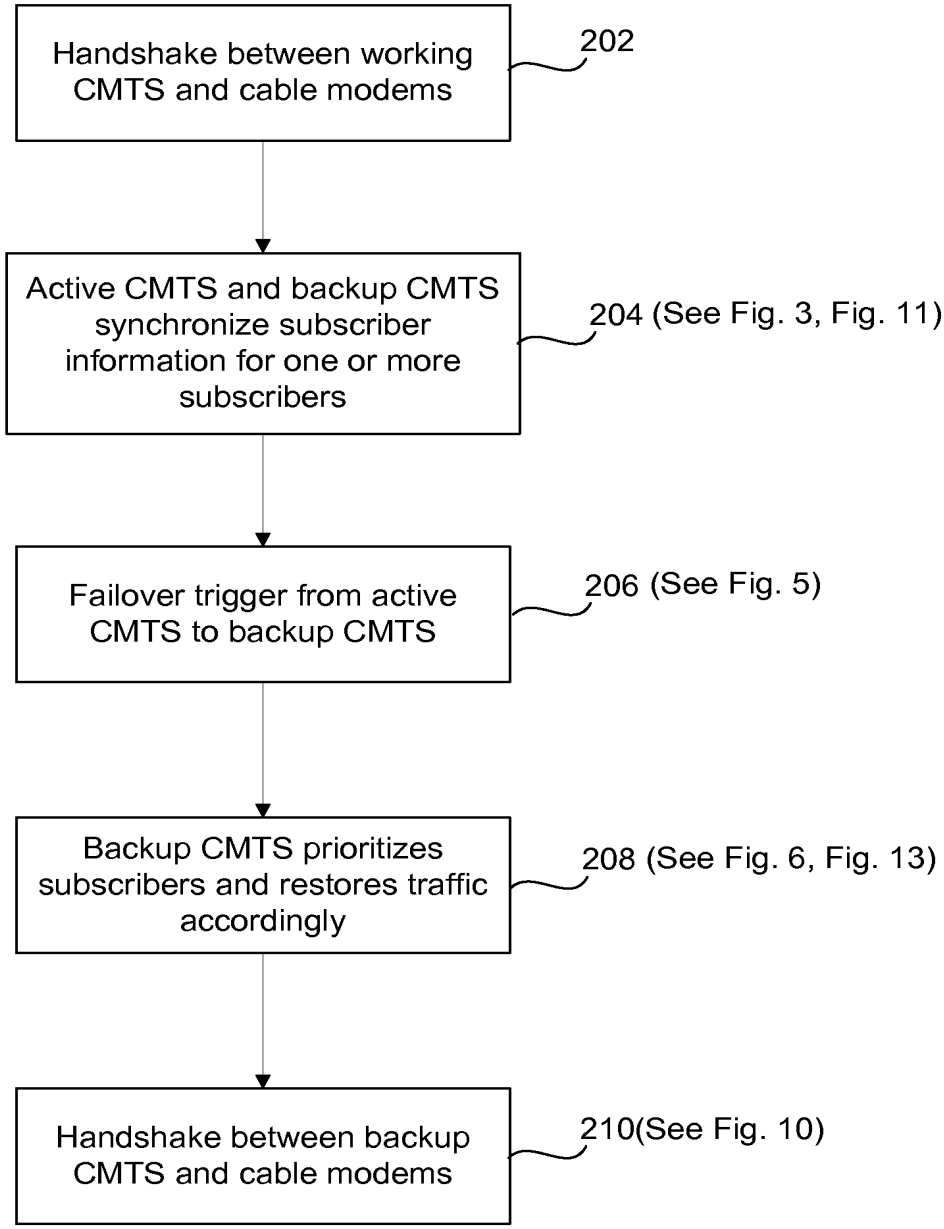

Handshake between working CMTS and cable modems
202
Active CMTS and backup CMTS synchronize subscriber information for one or more subscribers
204 (See Fig. 3, Fig. 11)
Failover trigger from active CMTS to backup CMTS
206 (See Fig. 5)
Backup CMTS prioritizes subscribers and restores traffic accordingly
208 (See Fig. 6, Fig. 13)
Handshake between backup CMTS and cable modems
210(See Fig. 10)

FIG. 2

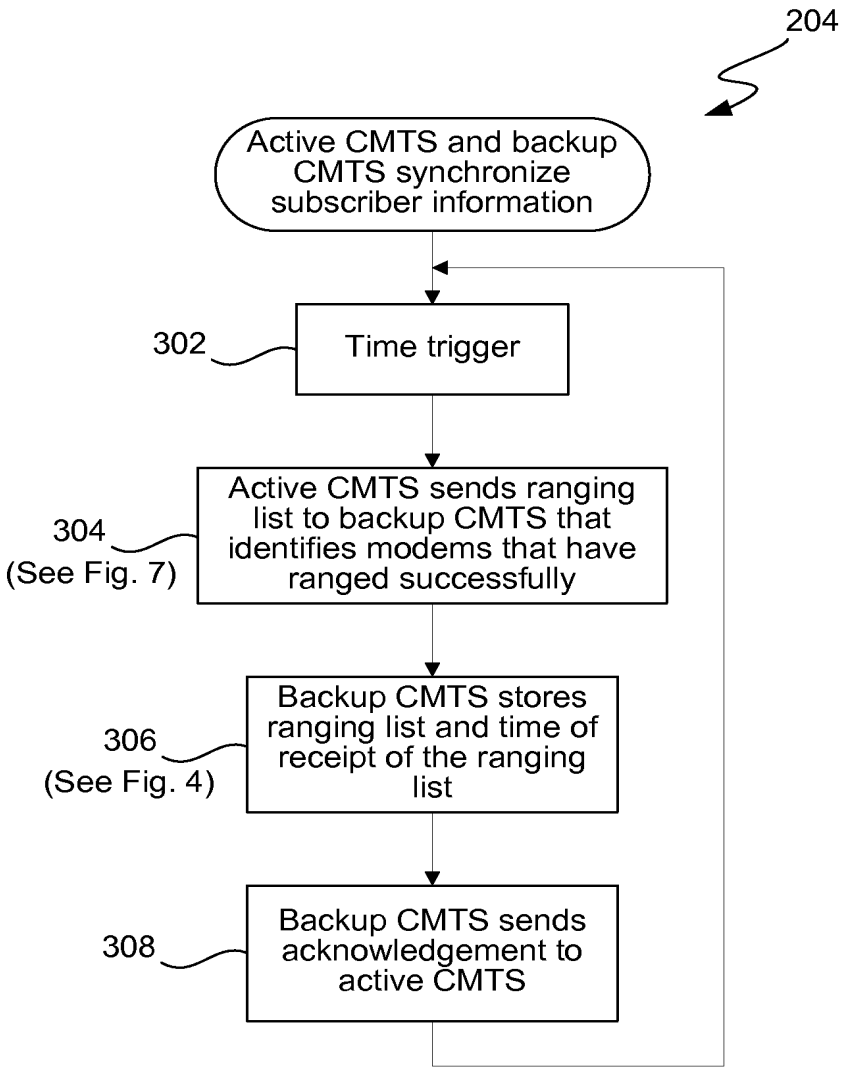

204
Active CMTS and backup CMTS synchronize subscriber information
302
Time trigger
Active CMTS sends ranging list to backup CMTS that identifies modems that have ranged successfully
304
(See Fig. 7)
Backup CMTS stores ranging list and time of receipt of the ranging list
306
(See Fig. 4)
Backup CMTS sends acknowledgement to active CMTS
308

FIG. 3

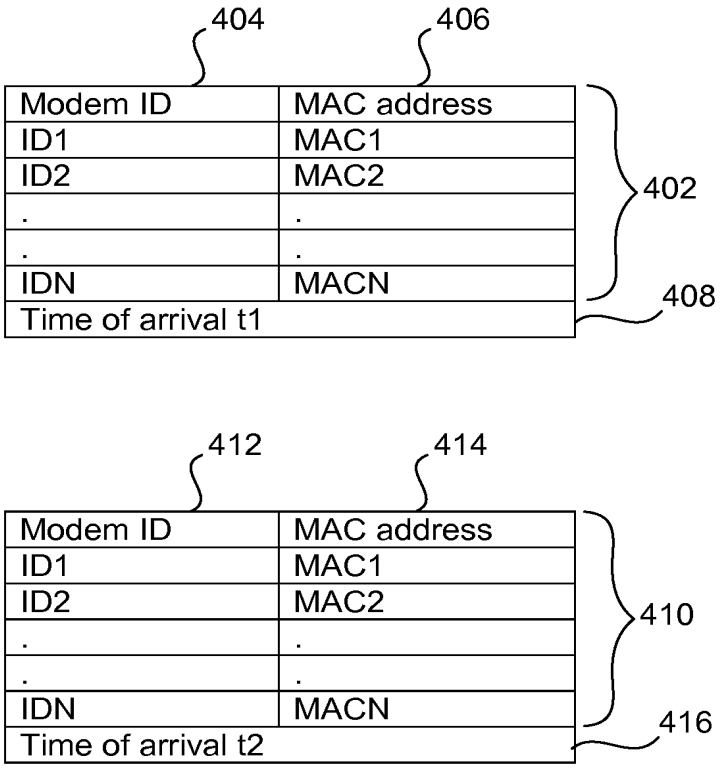

404
406
Modem ID
MAC address
ID1
MAC1
ID2
MAC2
.
.
.
.
IDN
MACN
402
Time of arrival t1
408
412
414
Modem ID
MAC address
ID1
MAC1
ID2
MAC2
.
.
.
.
IDN
MACN
410
Time of arrival t2
416

FIG. 4

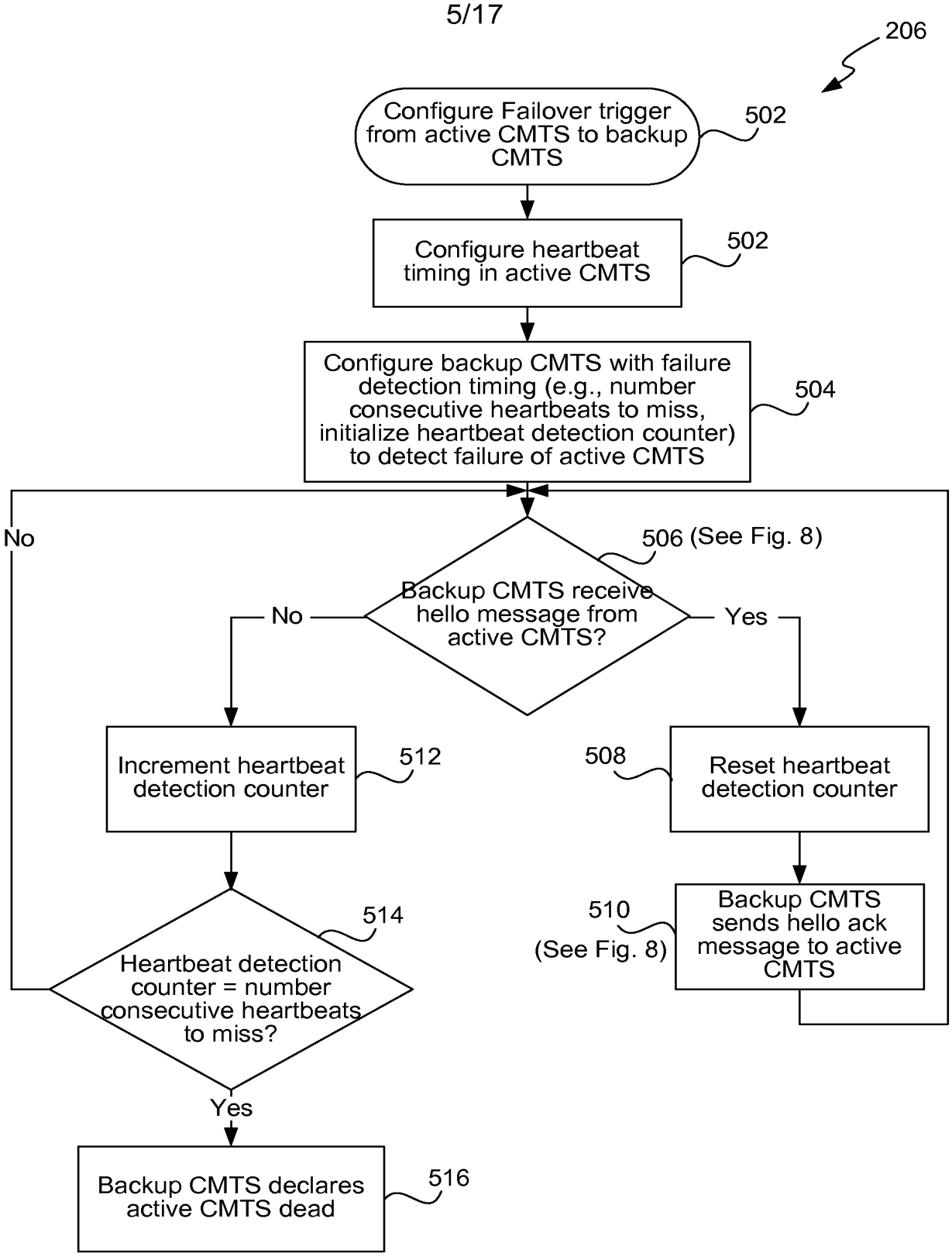

206
Configure Failover trigger from active CMTS to backup CMTS
502
Configure heartbeat timing in active CMTS
502
Configure backup CMTS with failure detection timing (e.g., number consecutive heartbeats to miss, initialize heartbeat detection counter) to detect failure of active CMTS
504
No
506 (See Fig. 8)
Backup CMTS receive hello message from active CMTS?
No
Yes
Increment heartbeat detection counter
512
508
Reset heartbeat detection counter
514
Heartbeat detection counter = number consecutive heartbeats to miss?
510
(See Fig. 8)
Backup CMTS sends hello ack message to active CMTS
Yes
Backup CMTS declares active CMTS dead
516

FIG. 5

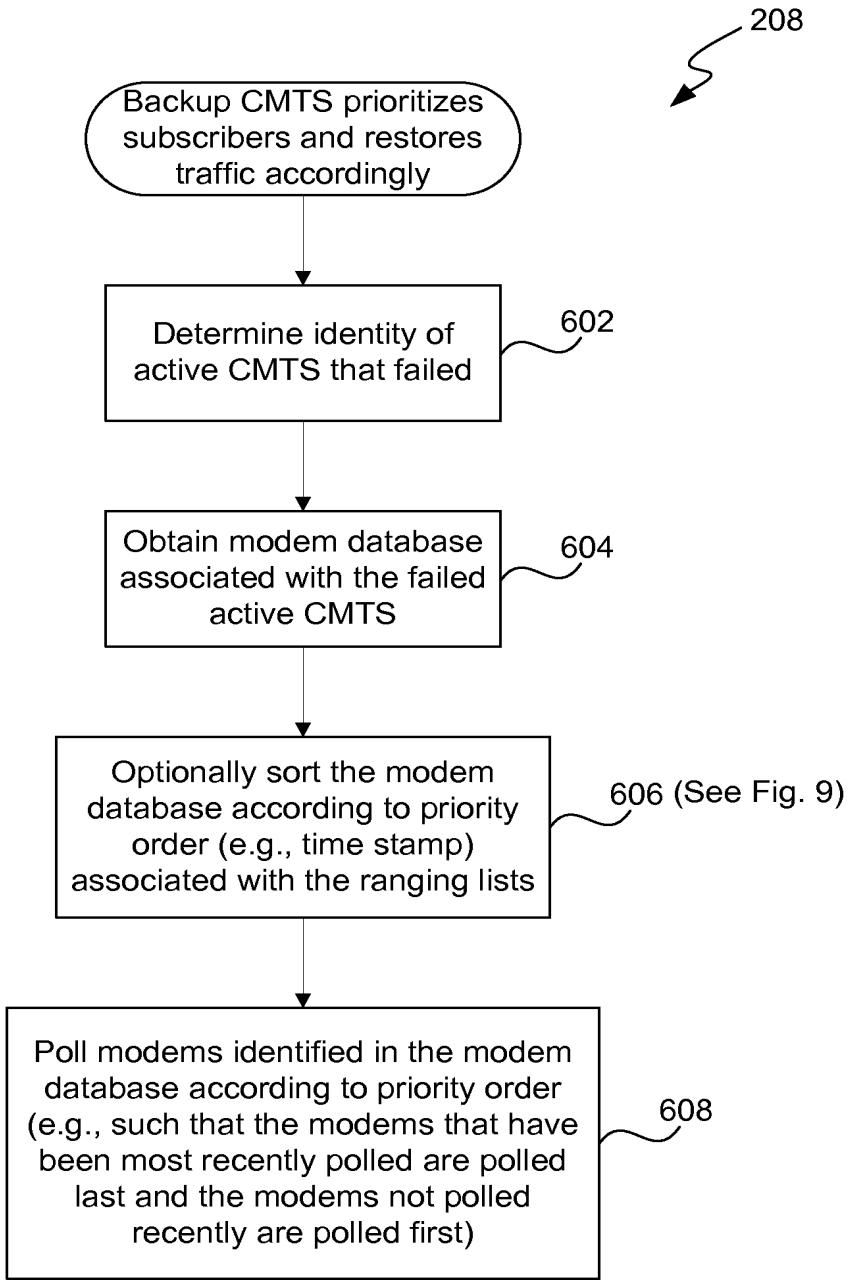

208
Backup CMTS prioritizes subscribers and restores traffic accordingly
Determine identity of active CMTS that failed
602
Obtain modem database associated with the failed active CMTS
604
Optionally sort the modem database according to priority order (e.g., time stamp) associated with the ranging lists
606 (See Fig. 9)
Poll modems identified in the modem database according to priority order (e.g., such that the modems that have been most recently polled are polled last and the modems not polled recently are polled first)
608

FIG. 6

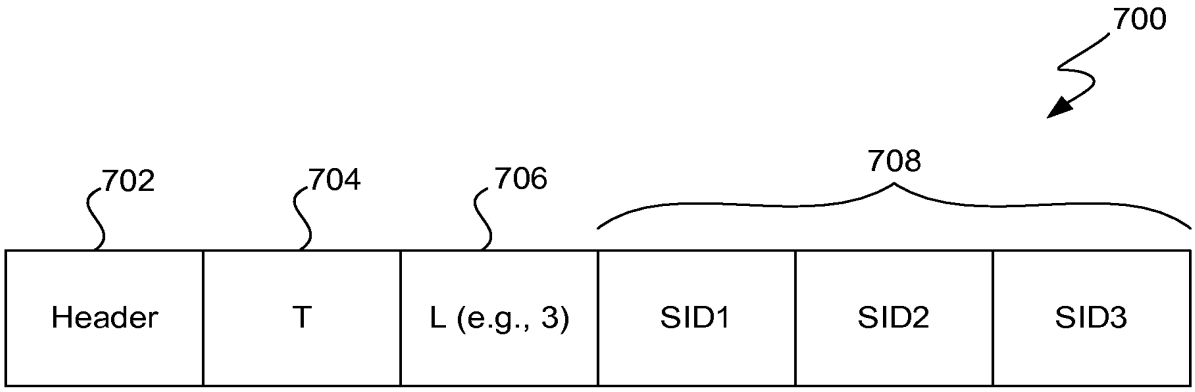

700
702
704
706
708
Header
T
L (e.g., 3)
SID1
SID2
SID3

FIG. 7

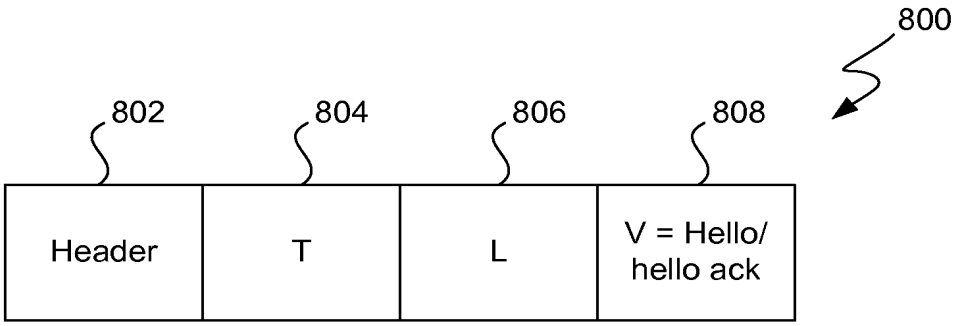

800
802
804
806
808
Header
T
L
V = Hello/
hello ack

FIG. 8

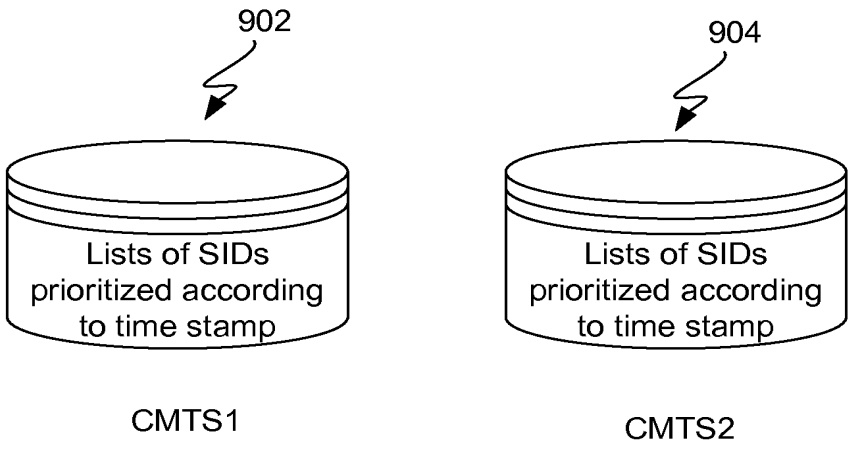

902
904
Lists of SIDs prioritized according to time stamp
Lists of SIDs prioritized according to time stamp
CMTS1
CMTS2

FIG. 9

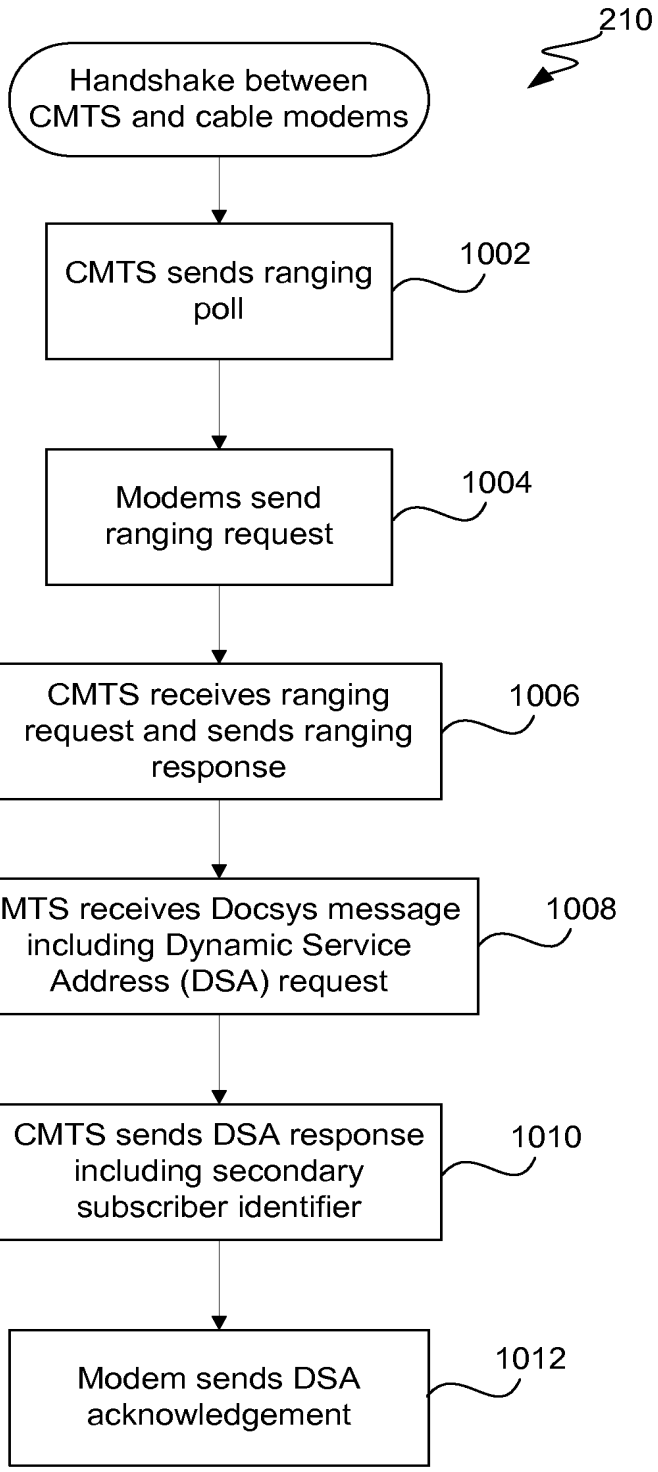

210
Handshake between CMTS and cable modems
CMTS sends ranging poll
1002
Modems send ranging request
1004
CMTS receives ranging request and sends ranging response
1006
CMTS receives Docsys message including Dynamic Service Address (DSA) request
1008
CMTS sends DSA response including secondary subscriber identifier
1010
Modem sends DSA acknowledgement
1012

FIG. 10

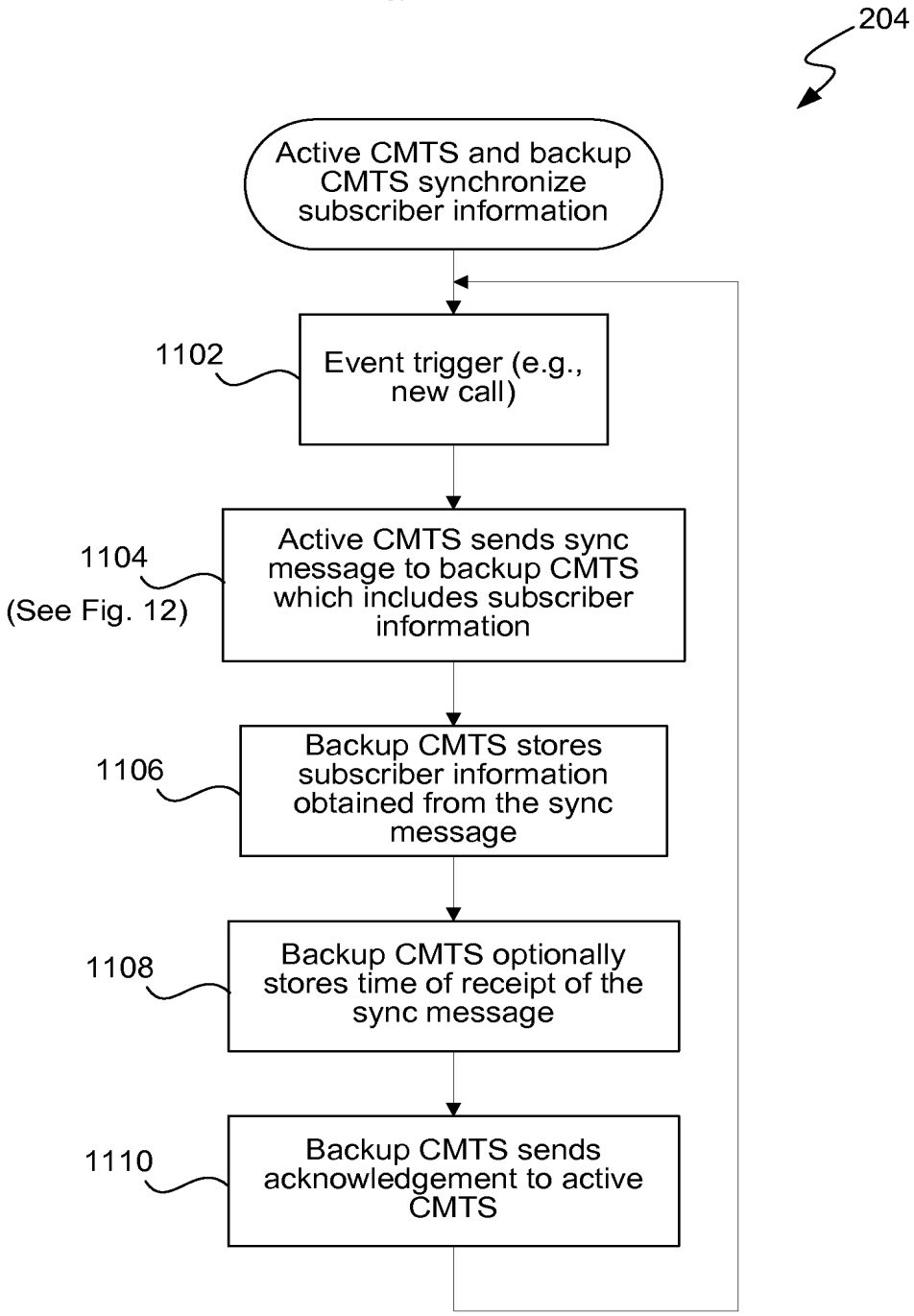
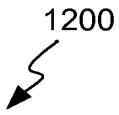

204
Active CMTS and backup CMTS synchronize subscriber information
1102
Event trigger (e.g., new call)
1104
(See Fig. 12)
Active CMTS sends sync message to backup CMTS which includes subscriber information
1106
Backup CMTS stores subscriber information obtained from the sync message
1108
Backup CMTS optionally stores time of receipt of the sync message
1110
Backup CMTS sends acknowledgement to active CMTS

FIG. 11



Sync message

Primary subscriber ID 1202	Secondary subscriber ID 1204
Service template including QOS requirements (e.g., scheduling type) 1206	
Packet classifier 1208	

FIG. 12

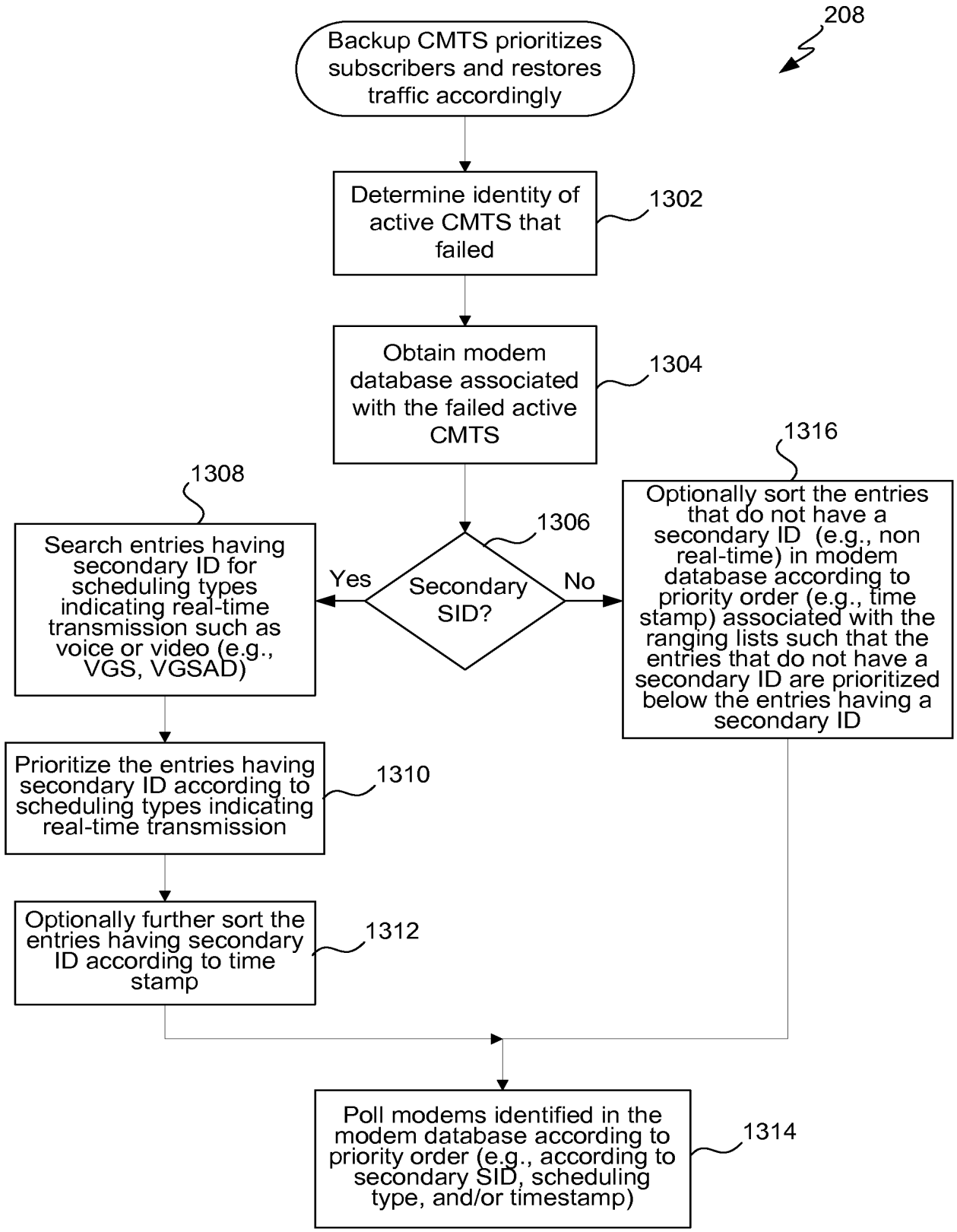

208
Backup CMTS prioritizes subscribers and restores traffic accordingly
Determine identity of active CMTS that failed
1302
Obtain modem database associated with the failed active CMTS
1304
1316
1308
Optionally sort the entries that do not have a secondary ID (e.g., non real-time) in modem database according to priority order (e.g., time stamp) associated with the ranging lists such that the entries that do not have a secondary ID are prioritized below the entries having a secondary ID
1306
Search entries having secondary ID for scheduling types indicating real-time transmission such as voice or video (e.g., VGS, VGSAD)
Yes
Secondary SID?
No
Prioritize the entries having secondary ID according to scheduling types indicating real-time transmission
1310
Optionally further sort the entries having secondary ID according to time stamp
1312
Poll modems identified in the modem database according to priority order (e.g., according to secondary SID, scheduling type, and/or timestamp)
1314

FIG. 13

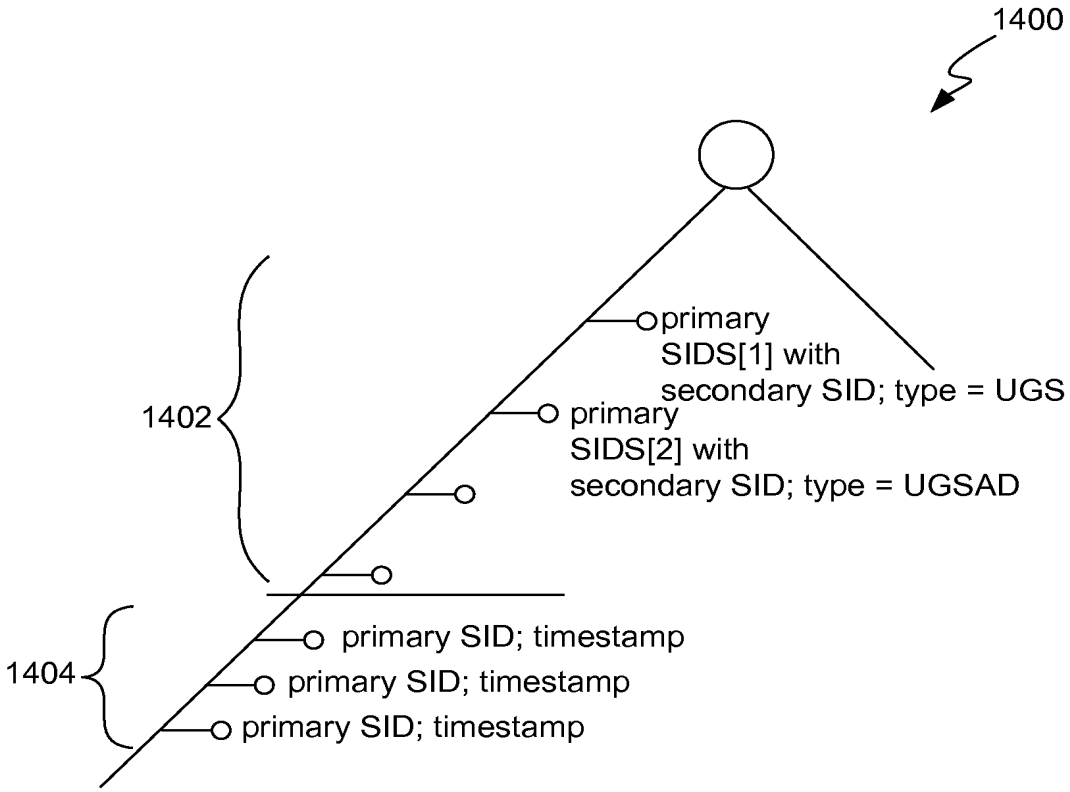

1400
1402
primary
SIDS[1] with
secondary SID; type = UGS
primary
SIDS[2] with
secondary SID; type = UGSAD
1404
primary SID; timestamp
primary SID; timestamp
primary SID; timestamp

FIG. 14

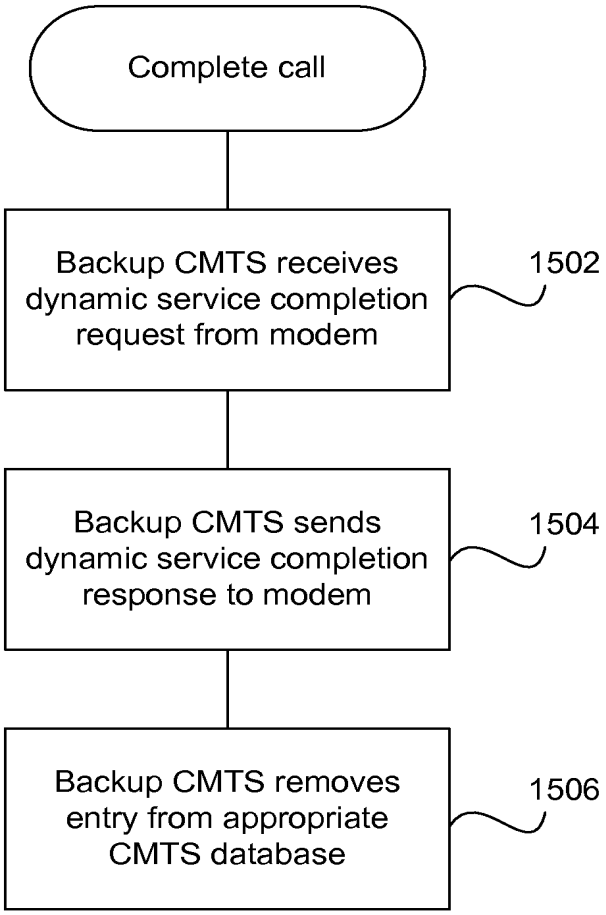

Complete call
Backup CMTS receives dynamic service completion request from modem
1502
Backup CMTS sends dynamic service completion response to modem
1504
Backup CMTS removes entry from appropriate CMTS database
1506

FIG. 15

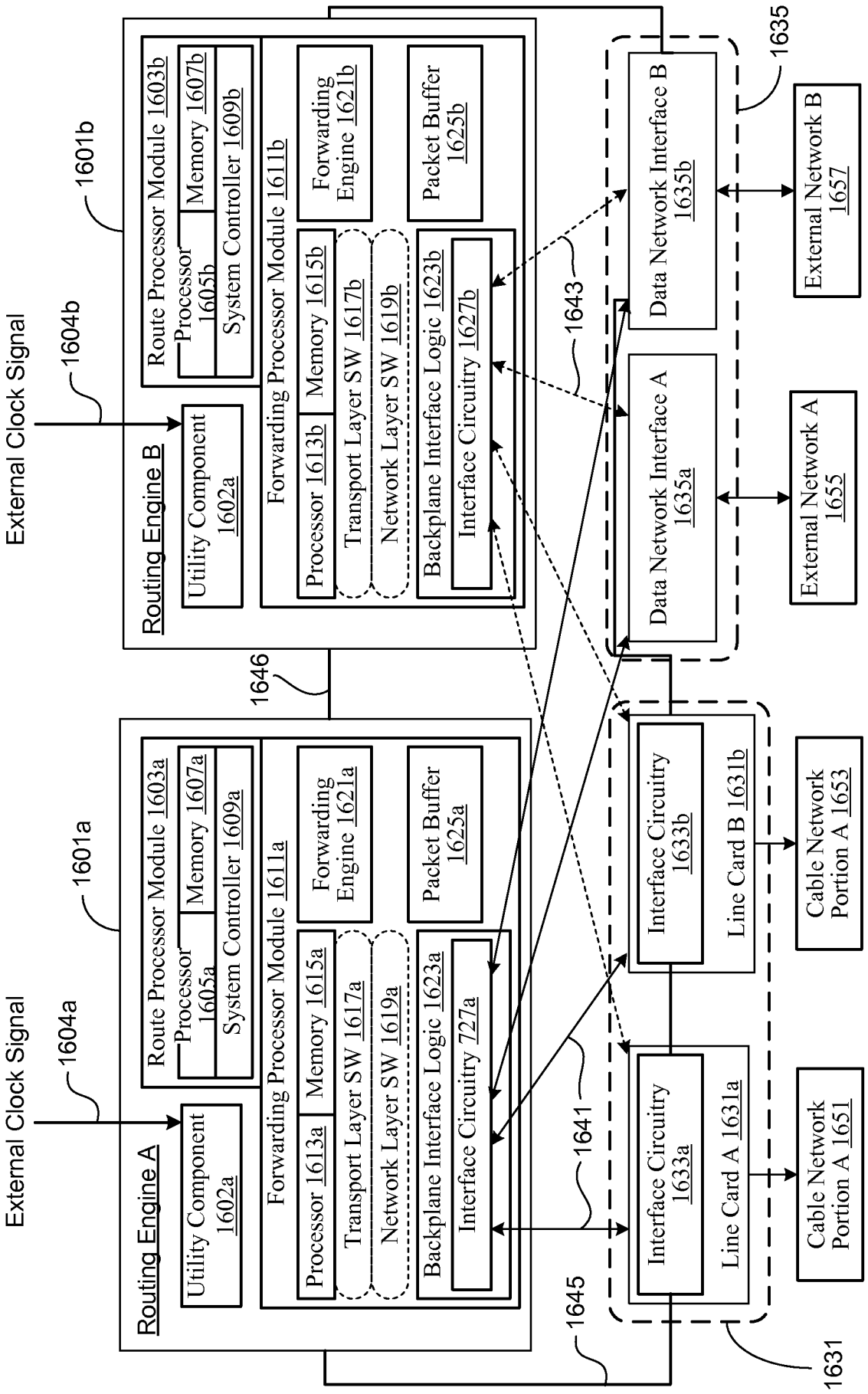

External Clock Signal
1604a
Routing Engine A
Utility Component 1602a
1601a
Route Processor Module 1603a
Processor 1605a
Memory 1607a
System Controller 1609a
Forwarding Processor Module 1611a
Processor 1613a
Memory 1615a
Transport Layer SW 1617a
Network Layer SW 1619a
Forwarding Engine 1621a
Backplane Interface Logic 1623a
Interface Circuitry 727a
Packet Buffer 1625a
1646
External Clock Signal
1604b
Routing Engine B
Utility Component 1602a
1601b
Route Processor Module 1603b
Processor 1605b
Memory 1607b
System Controller 1609b
Forwarding Processor Module 1611b
Processor 1613b
Memory 1615b
Transport Layer SW 1617b
Network Layer SW 1619b
Forwarding Engine 1621b
Backplane Interface Logic 1623b
Interface Circuitry 1627b
Packet Buffer 1625b
1643
1641
1645
1631
Interface Circuitry 1633a
Line Card A 1631a
Interface Circuitry 1633b
Line Card B 1631b
Data Network Interface A 1635a
Data Network Interface B 1635b
1635
Cable Network Portion A 1651
Cable Network Portion A 1653
External Network A 1655
External Network B 1657
1600

FIG. 16

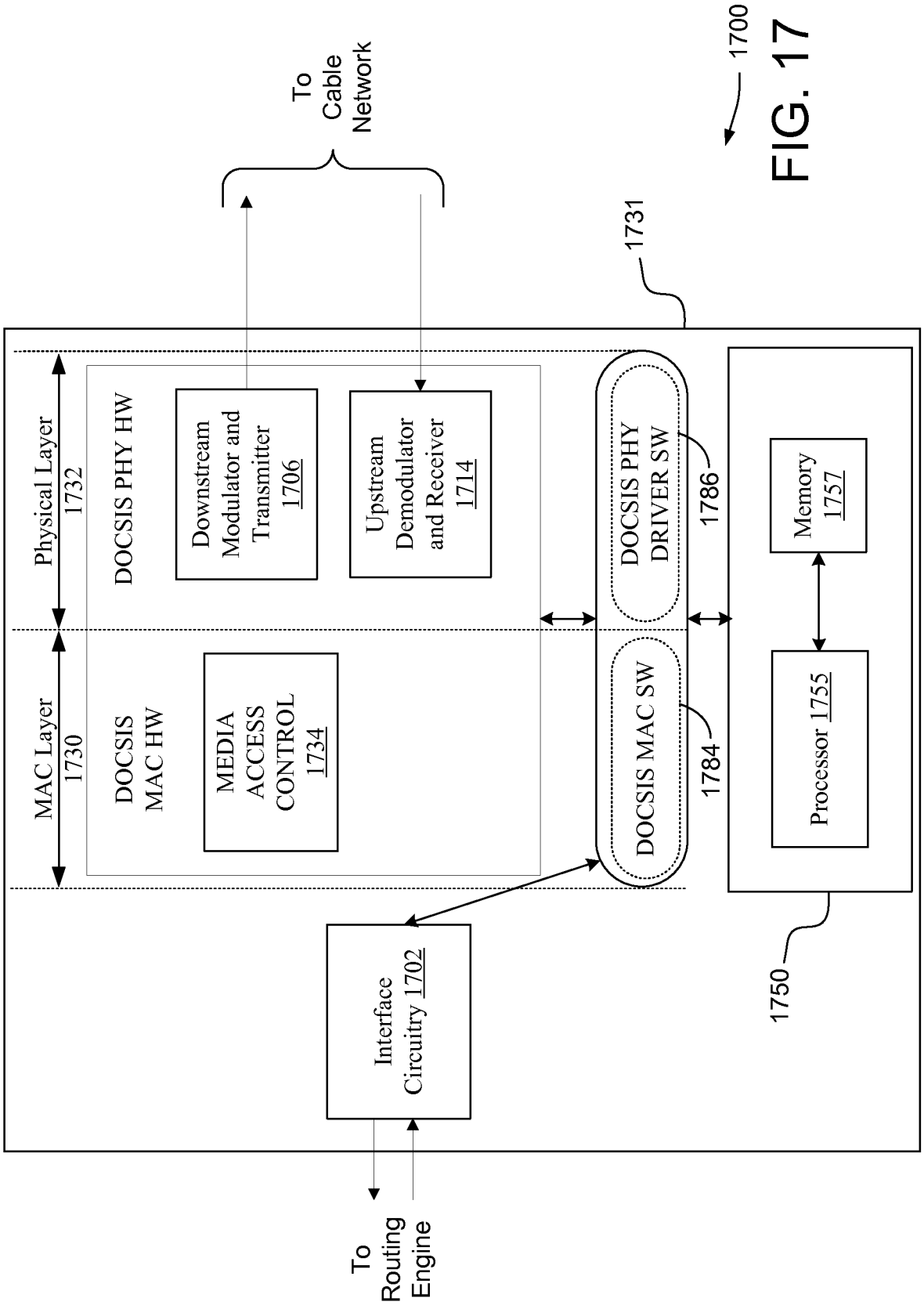

1700
To Cable Network
1731
Physical Layer 1732
DOCSIS PHY HW
Downstream Modulator and Transmitter 1706
Upstream Demodulator and Receiver 1714
DOCSIS PHY DRIVER SW
1786
Memory 1757
MAC Layer 1730
DOCSIS MAC HW
MEDIA ACCESS CONTROL 1734
DOCSIS MAC SW
1784
Processor 1755
Interface Circuitry 1702
1750
To Routing Engine

FIG. 17

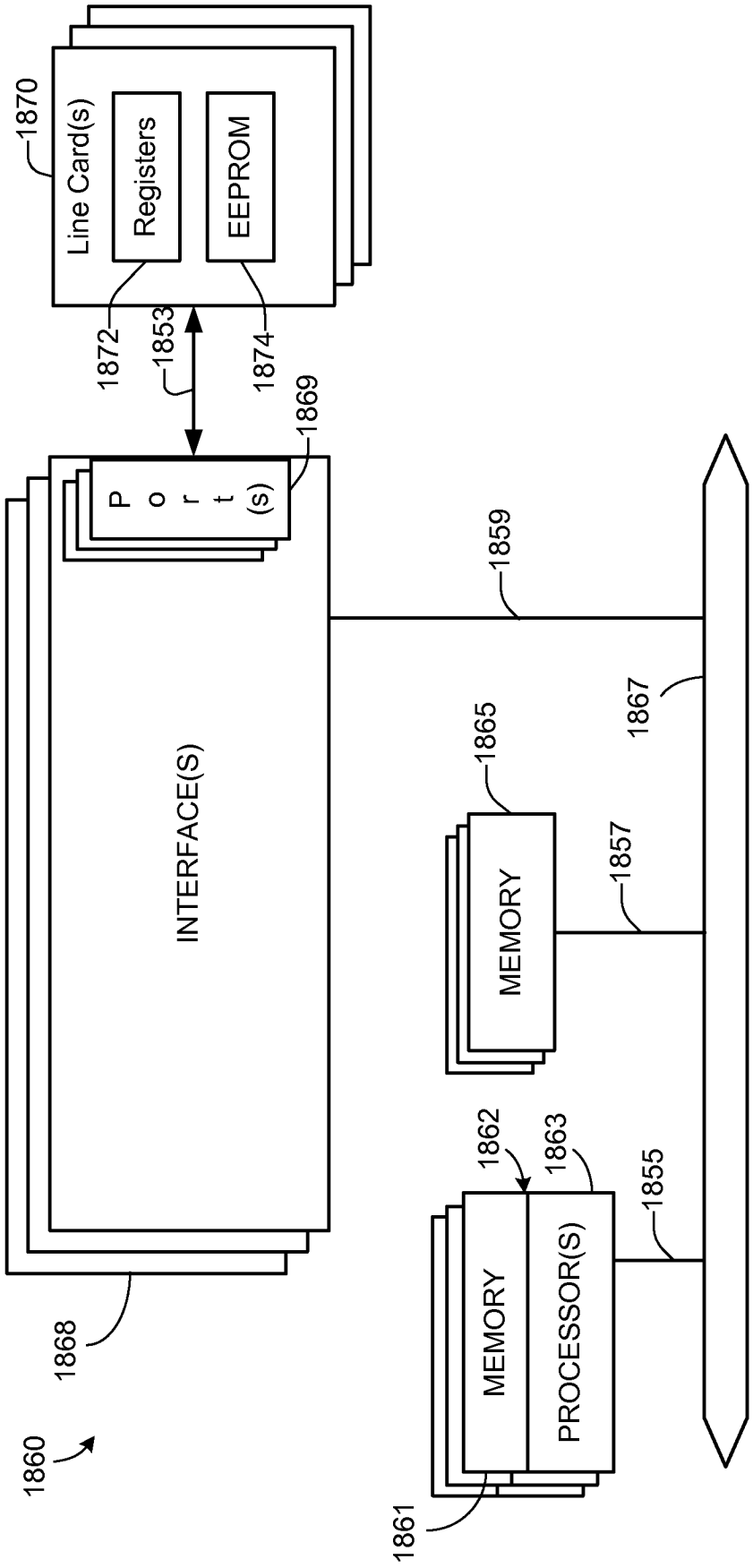

1870
Line Card(s)
Registers
EEPROM
1872
1853
1874
1869
Port(s)
1859
1867
1865
MEMORY
1857
1862
1863
1855
MEMORY
PROCESSOR(S)
INTERFACE(S)
1868
1860
1861

FIG. 18